

Wildlife Populations: Horseshoe Crab

Background

Horseshoe crabs, *Limulus polyphemus*, are important to a diverse set of users. They lay their eggs on sandy beaches in spring and summer, and migrating shorebirds rely heavily on their eggs to supply energy required to complete their migration. Biomedical companies catch horseshoe crabs for their blood, from which they produce Limulus Amebocyte Lysate (LAL). LAL is used to detect contamination of injectable drugs and implantable devices; it is the most sensitive means available for detecting endotoxins, which are part of the outer membrane of the cell wall of certain bacteria, such as *E. coli* and *Salmonella*. Finally, horseshoe crabs are harvested commercially for bait to catch American eels, catfish, and whelk. Horseshoe crabs are a particularly important issue here in New Jersey because the Delaware Bay is the center of horseshoe crab abundance on the Atlantic coast.¹

Adult horseshoe crabs winter in water 20 to 60 feet deep on the continental shelf. Increased water temperature and amount of daylight stimulate adult migration toward sandy beaches for spawning. The peak migration in the Delaware Bay generally occurs during the evening and full moon tides in May and June. Females dig a shallow hole, ranging from 5 to 30 centimeters, below their bodies and deposit their eggs in clumps within the intertidal zone. Weather can negatively affect spawning by disrupting spawning sites, driving animals off the beach, diminishing the number of pairs able to spawn, or preventing them from coming to the beach at all.²

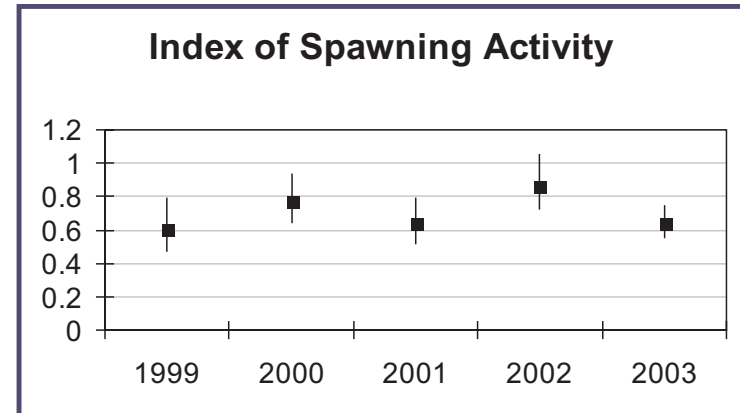
Horseshoe crabs molt numerous times as they grow from larval stage, shedding their exoskeleton at least 16 or 17 times before reaching sexual maturity. Horseshoe crabs require nine to 10 years to reach maturity, when they cease to molt, and may reach a maximum age of 20 years.³

Trend

In 1999, the US Geological Survey (USGS) and DEP's Division of Fish and Wildlife began a study on horseshoe crab spawning. Although spawning studies have been performed since 1990, the new study was redesigned to be standardized and more statistically valid. This study surveyed the Index of Spawning Activity (ISA). The ISA is the density of females on surveyed beaches per night. It is not valid to extrapolate this num-

ber to a total population because some spawning habitat is neither accessible nor included in the survey, and sampling is limited to the week around the new and full moon.

While the ISA has its limitations, it is a reliable measure of relative abundance and is useful for monitoring trends in spawning activity. The data from this study shows that the ISA has not declined since the beginning of the study, but it does show some variability from year to year.⁴ However, it is believed that the sampling effort began after the crab population was already significantly diminished, which would explain the low, but seemingly stable population.⁵ Continued monitoring is important.



Outlook and Implications

With concern rising as to the status of the horseshoe crab population, alternatives are being explored to reduce the number of horseshoe crabs needed for medical and commercial fishing uses. Each of the five biomedical companies currently bleeding horseshoe crabs have experimented with developing a synthetic compound that mimics the behavior of LAL. However, a compound that is as successful at detecting endotoxin has yet to be found. The culturing of cells to produce LAL also has been tried, and while there have been several reports of limited success, commercial production is not viable at this time.⁶

Efforts also are under way to look for alternatives to horseshoe crabs as bait. In order to decrease the number of crabs used, some commercial fisheries have begun to encase the crabs in bait bags, which prolongs the life of the bait by lifting it off the seafloor and preventing predators from consuming it. A variety of alternate baits have been tested, including surf clams, green crabs, and the addition of haemolymph, which is the horseshoe crab's circulatory fluid, to an alternate bait. It is readily available because it is byproduct from the horseshoe crab blood-extraction process. Finally, researchers have been experimenting with synthesizing artificial bait from a chemical compound found in horseshoe crab eggs that might be what attracts eel and whelk to the horseshoe crab.⁷

In addition, horseshoe crab harvest has been tightly regulated since 1993 under N.J.A.C. 7:25.⁸

More Information

For more information, visit www.lsc.usgs.gov/aeb/2065

References

- ¹ Hata, D and J. Berkson. 2003. Abundance of horseshoe crabs (*Limulus polyphemus*) in the Delaware Bay area. *Fishery Bulletin* 101:933-938.
- ² Walls, E. A., J. Berkson, and S. A. Smith. 2002. The Horseshoe Crab, *Limulus polyphemus*: 200 Million Years of Existence, 100 Years of Study.
- ³ Walls, et al., 2002
- ⁴ Smith, D and S. Bennett. 2004. Horseshoe Crab Spawning Activity in Delaware Bay: 5 years of a standardized and statistically robust survey. Report to ASMFC Horseshoe Crab Management Board
- ⁵ Dey, Amanda, NJDEP, Division of Fish & Wildlife, personal communication
- ⁶ Walls, et al., 2002
- ⁷ Walls, et al., 2002
- ⁸ <http://www.nj.gov/dep/fgw/pdf/2004/comregs04.pdf>